

US-PAT-NO: 5322064

DOCUMENT-IDENTIFIER: US 5322064 A

TITLE: Torquable catheter and method

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Detailed Description Text - DETX (96):

Operation and use of the torquable catheter 501 shown in FIGS. 37-50 may now be briefly described as follows. Let it be assumed that it is desired to adjust the handle 506 for the maximum bend which can be placed in the tip section 511c and in the tractable or curve section 511b. This adjustment is accomplished outside of the human body while observing the distal extremity of the torquable cathode 501. Let it be assumed that it is desired to place a desired bend in the tractable or curve section 511b. This is accomplished by holding the catheter 501 in one hand and holding the tractable section 511b in the other hand and grasping the tractable section 511b between two fingers of the other hand and placing a curvature or bend in the direction desired. This section 511b is tractable or malleable and retains at least a portion of the curvature or bend placed in the same primarily because of the malleability of the stainless steel used in that section. Thus, a preform is placed in the section 511b. Thereafter, the knob 581 carrying the collar 578 and the hemispherical protrusion 598 are rotated to cause a pulling force to be applied to the pull string 561 which causes a pulling force to be applied to the coil spring 562 anchoring the distal extremity of the pull string 561 to cause further bending to occur in the direction of the preform

already established  
utilizing the distal extremity of the coil spring 567 as  
the back-up spring.  
Rotation of the knob 581 is continued until the maximum  
desired curvature is  
placed in the tractable section 511b. Because of the  
frictional engagement  
between the washers 602 and 603 associated with the knob  
581, the knob will be  
retained in this position. The amount of friction which  
can be provided by the  
washers 602 and 603 can be readily adjusted by tightening  
or loosening the  
Phillips-head screw 589 which causes axial adjustment of  
the knob and the  
capstan relative to the housing 576.

Detailed Description Text - DETX (99):

Let it be assumed that the torquable catheter 501 has  
been adjusted in the  
manner hereinbefore described and that it is desired to  
utilize the same in a  
mapping and/or ablation procedure. Assuming that the  
elongate flexible shaft  
502 is in a straight position, a slight bend is provided in  
the tractable  
section 511b of the distal extremity of the elongate  
flexible shaft 502 as, for  
example, by grasping the handle 506 in the left hand and  
then using the thumb  
and the forefinger of the right hand and engaging the  
tractable section 511b to  
place a slight curve in the same as hereinbefore described  
as shown by the  
dotted line portions of section 511b in FIG. 35A. This  
slight bend or preform  
can be placed in the section 511b in any direction  
extending through  
360.degree. of rotation about the Z-axis as shown in FIG  
35A. In making this  
bend at the tractable section 511a, it is important to make  
the bend in the  
desired angle since this section 511b is tractable, in  
other words, is  
malleable and it will retain at least some of this bend  
after it is released by  
the fingers of the hand.

Claims Text - CLTX (14):

14. A catheter comprising an elongate flexible body having a longitudinal axis, a proximal end and a distal end, the body including a malleable metal wall having at least one slotted-wall segment proximal of the distal end that includes at least one slot extending through the wall that subtends an angle of less than 360.degree. so that at least one slotted-wall segment is capable of retaining at least one different curvature in response to external manipulation, a flexible sleeve of shrink tubing enclosing and in contact with the slotted-wall segment to permit the slotted-wall segment to bend along the axis but inhibiting placing a permanent strain in said slotted-wall segment, first means on the proximal end of the body for applying rotational torque for rotating the body about the longitudinal axis by transmitting the rotational torque to and through the slotted-wall segment and second means on the proximal end of the body and extending to the distal end of the body for transmitting a bending force to the distal end of the body.

Claims Text - CLTX (20):

20. A catheter according to claim 14 wherein the elongate flexible body includes an additional slotted-wall segment that is spaced from said at least one slotted-wall segment and including a malleable metal wall having at least one slot extending through the wall that subtends an angle of less than 360.degree., that is capable of retaining at a different radial angle another curvature different from said one different curvature and wherein the flexible sleeve also encloses and is in contact with the additional slotted-wall segment to permit the additional slotted-wall segment to bend but

inhibiting the  
placement of a permanent strain therein.

Claims Text - CLTX (23):

23. A catheter comprising an elongate flexible body having a longitudinal axis, a proximal end and a distal end, the body including a malleable wall having at least one slotted-wall segment proximal of the distal end that includes at least one slot extending through the wall that subtends an angle of less than 360.degree. so that said at least one slotted-wall segment is capable of retaining at least one different curvature in response to external manipulation, a flexible sleeve encasing said slotted-wall segment to permit the slotted-wall segment to bend along the axis without breaking, first means on the proximal end of the body for applying rotational torque for rotating the body about the longitudinal axis by transmitting the rotational torque to and through the slotted-wall segment and second means on the proximal end of the body and extending to the distal end of the body for transmitting a bending force to the distal end of the body, said elongate flexible body including an additional slotted-wall segment that is spaced from said at least one slotted-wall segment and including a malleable wall having at least one slot extending through the wall that subtends an angle of less than 360.degree. that is capable of retaining at a different radial angle another curvature different from said one different curvature, said flexible sleeve also enclosing the additional slotted-wall segment to permit the additional slotted-wall segment to bend without breaking, said at least one slotted-wall segment including a first array of slots, each slot subtending an angle of less than 360.degree. to impart flexibility in more than two

bend directions about the longitudinal axis, said additional slotted wall segment including a second array of slots with each slot in the second array of slots subtending an angle of less than 360.degree. and differing from the first array to impart flexibility in no more than two bend directions about the longitudinal axis.

Claims Text - CLTX (26):

26. A catheter comprising an elongate flexible body having a longitudinal axis, a proximal end and a distal end, the body including a malleable metal wall having at least one slotted-wall segment proximal of the distal end that includes at least one slot extending through the wall that subtends an angle of less than 360.degree. so that at least one slotted-wall segment is capable of retaining at least one different curvature in response to external manipulation, a flexible sleeve of shrink tubing enclosing and in contact with the slotted-wall segment to permit the slotted-wall segment to bend along the axis but inhibiting placing a permanent strain in said slotted-wall segment, first means on the proximal end of the body for applying rotational torque for rotating the body about the longitudinal axis by transmitting the rotational torque to and through the slotted-wall segment and second means on the proximal end of the body and extending to the distal end of the body for transmitting a bending force to the distal end of the body, said at least one slotted-wall segment comprising a plurality of segments aligned along the longitudinal axis with a plurality of slots therebetween and having interconnecting hinges permitting bending at the hinges.

Claims Text - CLTX (29):

29. A catheter comprising an elongate flexible body having a longitudinal axis, a proximal end and a distal end, the body including a malleable wall having at least one slotted-wall segment proximal of the distal end that includes at least one slot extending through the wall that subtends an angle of less than 360.degree. so that said at least one slotted-wall segment is capable of retaining at least one different curvature in response to external manipulation, a flexible sleeve encasing the slotted-wall segment to permit the slotted-wall segment to bend along the axis without breaking, first means on the proximal end of the body for applying rotational torque for rotating the body about the longitudinal axis by transmitting the rotational torque to and through the slotted-wall segment and second means on the proximal end of the body and extending to the distal end of the body for transmitting a bending force to the distal end of the body, said at least one slotted-wall segment comprising a plurality of segments aligned along the longitudinal axis with a plurality of slots therebetween and having interconnecting hinges permitting bending at the hinges, the slots having a width which determines the maximum amount of bending between one segment and another.

Claims Text - CLTX (30):

30. A catheter comprising an elongate flexible body having a longitudinal axis, a proximal end and a distal end, the body including a malleable wall having at least one slotted-wall segment proximal of the distal end that includes at least one slot extending through the wall that subtends an angle of less than 360.degree. so that said at least one slotted-wall segment is capable of retaining at least one different curvature in response to external

manipulation, a flexible sleeve encasing the slotted-wall segment to permit the slotted-wall segment to bend along the axis without breaking, first means on the proximal end of the body for applying rotational torque for rotating the body about the longitudinal axis by transmitting the rotational torque to and through the slotted-wall segment and second means on the proximal end of the body and extending to the distal end of the body for transmitting a bending force to the distal end of the body, said first means being in the form of a handle adapted to be grasped by the human hand, said second means including first and second pull strings secured to the handle and to the distal end of the body and extending through the body means carried by the handle for pulling on said pull strings for causing bending of the distal end of the body, said body being provided with a tip section and a tractable section proximal of the tip section and means for connecting said first pull string to said tip section and said second pull string to said tractable section whereby the tip section can be bent by pulling on first said pull string and the tractable section can be bent by pulling on said second pull string.

Claims Text - CLTX (32):

32. A catheter comprising an elongate flexible body having a longitudinal axis, a proximal end and a distal end, the body including a malleable wall having at least one slotted-wall segment proximal of the distal end that includes at least one slot extending through the wall that subtends an angle of less than 360.degree. so that said at least one slotted-wall segment is capable of retaining at least one different curvature in response to external manipulation, a flexible sleeve encasing the slotted-wall segment to permit the

slotted-wall segment to bend along the axis without breaking, first means on the proximal end of the body for applying rotational torque for rotating the body about the longitudinal axis by transmitting the rotational torque to and through the slotted-wall segment and second means on the proximal end of the body and extending to the distal end of the body for transmitting a bending force to the distal end of the body, said first means being in the form of a handle adapted to be grasped by the human hand, said second means including first and second pull strings secured to the handle and to the distal end of the body and extending through the body, means carried by the handle for pulling on said pull strings for causing bending of the distal end of the body and a coil spring jacket disposed on each of said first and second pull strings for minimizing friction between the first and second pull strings and for minimizing friction between the first and second pull strings and the malleable wall.

Claims Text - CLTX (33):

33. A catheter comprising an elongate flexible body having longitudinal axis, a proximal end and a distal end, the body including a malleable wall having at least one slotted-wall segment proximal of the distal end that includes at least one slot extending through the wall that subtends an angle of less than 360.degree. so that said at least one slotted-wall segment is capable of retaining at least one different curvature in response to external manipulation, a flexible sleeve encasing the slotted-wall segment to permit the slotted-wall segment to bend along the axis without breaking, first means on the proximal end of the body for applying rotational torque for rotating the



body about the longitudinal axis by transmitting the rotational torque to and through the slotted-wall segment and second means on the proximal end of the body and extending to the distal end of the body for transmitting a bending force to the distal end of the body, said first means being in the form of a handle adapted to be grasped by the human hand, said second means including first and second pull strings secured to the handle and to the distal end of the body and extending through the body and means carried by the handle pulling on said pull strings for causing bending of the distal end of the body and, said first and second pull strings being formed of Kevlar.

Claims Text - CLTX (34):

34. A catheter comprising an elongate flexible body having a longitudinal axis, a proximal end and a distal end, the body including a malleable wall having at least one slotted-wall segment proximal of the distal end that includes at least one slot extending through the wall that subtends an angle of less than 360.degree. so that said at least one slotted-wall segment is capable of retaining at least one different curvature in response to external manipulation, a flexible sleeve encasing the slotted-wall segment to permit the slotted-wall segment to bend along the axis without breaking, first means on the proximal end of the body for applying rotational torque for rotating the body about the longitudinal axis by transmitting the rotational torque to and through the slotted-wall segment, second means on the proximal end of the body and extending to the distal end of the body of transmitting a bending force to the distal end of the body, said at least one slotted-wall segment comprising a plurality of segments aligned along the longitudinal axis with a plurality of

slots therebetween and having interconnecting hinges  
permitting bending at the  
hinges and superelastic memory metal elements disposed  
within the hinges and  
extending into the segments to urge the segments to return  
to a position in  
which the hinges are not bent.

Current US Original Classification - CCOR (1):  
600/381